User Guide for

FEBFDMQ8203_25 W GreenBridge™ Evaluation Kit for Power Over Ethernet 25 W Flyback DC-DC

MLP 4.5x5 GreenBridge™

Featured Fairchild Product: FDMQ8203

Direct questions or comments about this evaluation board to: "Worldwide Direct Support"

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The following user guide supports the evaluation kit for the MLP4.5x5 GreenBridge™. It should be used in conjunction with the FDMQ8203 datasheet as well as Fairchild's application notes and technical support team. Please visit Fairchild's website at www.fairchildsemi.com.

1. Introduction

This board is designed to rectify the positive and negative power source from Power Source Equipment (PSE) and regulate 48 V (42 V ~ 57 V) to provide 5 V_{OUT}, 0-5 A with 250 kHz switching frequency. The board meets the required specification under IEEE802.3af.

1.1. Description

This kit contains the MLP 4.5x5 GreenBridge™ MOSFET evaluation board.

1.2. Features

- GreenBridge™ FDMQ8203 Quad P&N-Channel MOSFET
- Flyback Primary Switch FDS86242 Single N-Channel MOSFET
- Flyback Secondary Switch FDMC7692S Single N-Channel MOSFET
- Controller IEEE802.3at PD with Flyback Controller
- Output-Voltage Range 5 V, Adjustable by R11 and R10
- Switching Frequency 250 kHz, Adjustable by C50
- Maximum Output Current 5 A, Limited by Power Component

2. Evaluation Board Specifications

Table 1. GreenBridge™ MOSFET Parameters

Part Number	Location	BV_{DSS} (V)	$R_{DS(ON)}$ [mΩ]	Qg [nC]	C_{OSS} [pF]
			Max.	Typ.	Typ.
FDMQ8203	Q1, Q4	100	175 at 6 V_{GS}	1.8 at 5 V_{GS}	47
	Q2, Q3	-80	235 at 4.5 V_{GS}	6.8 at 4.5 V_{GS}	49

3. Photographs

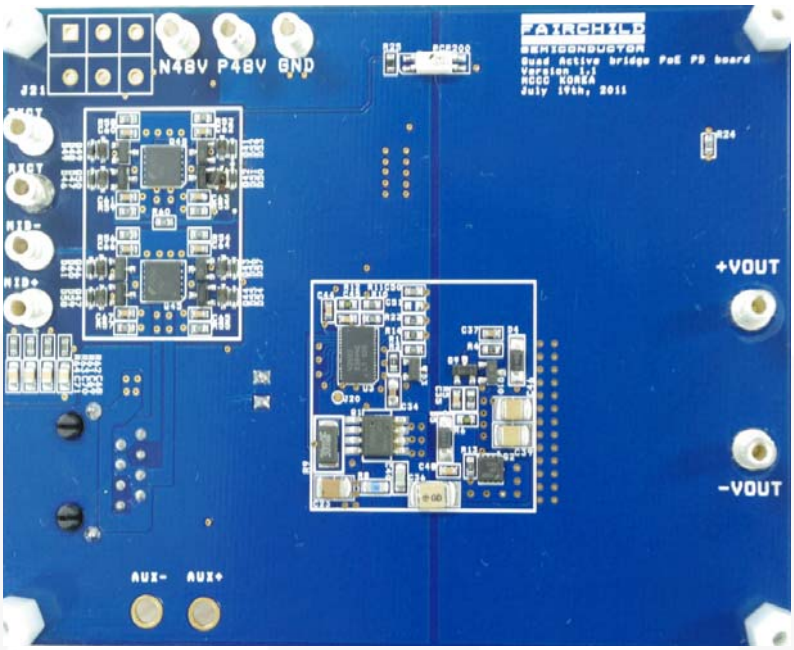


Figure 1. Top Side View of Evaluation Kit

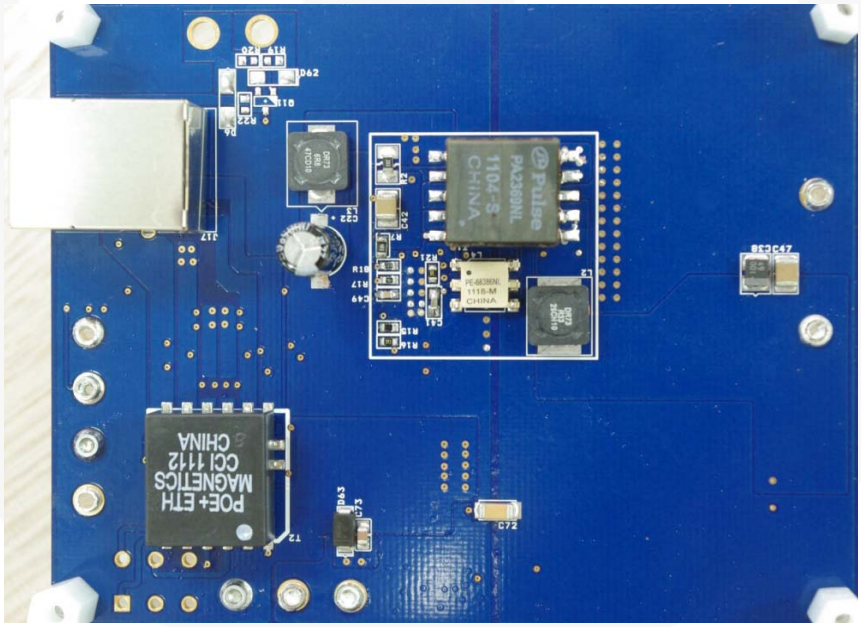


Figure 2. Bottom Side View of Evaluation Kit

4. Printed Circuit Board

PCB layout (100 mm x 80 mm, 4 Layer).

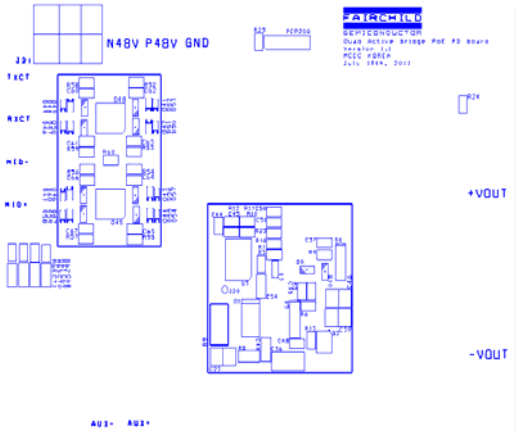


Figure 3. SST (Component Side) Layer

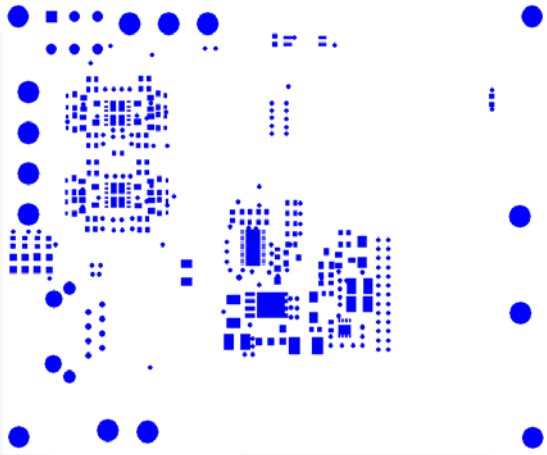


Figure 4. SMT (Mounting Side) Layer

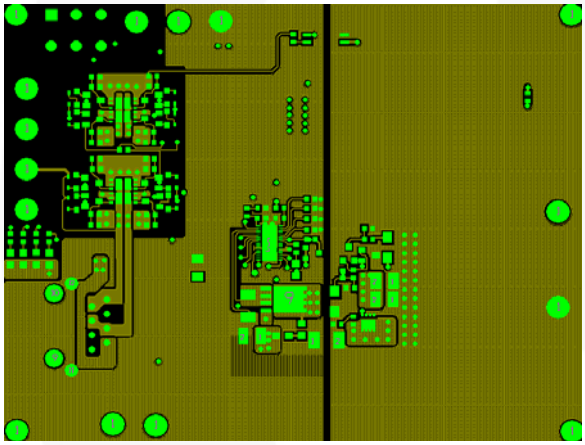


Figure 5. TOP & SMT Layer

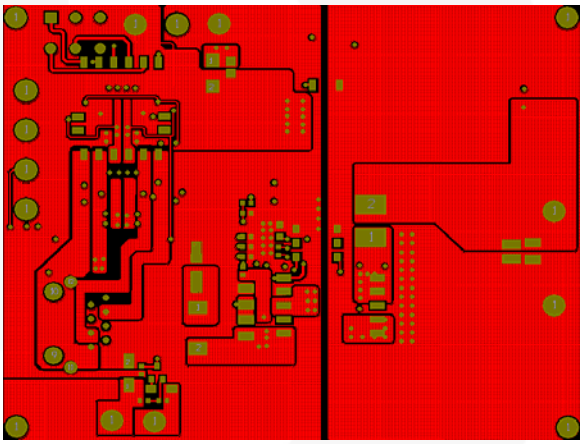


Figure 6. BOT & SMB Layer

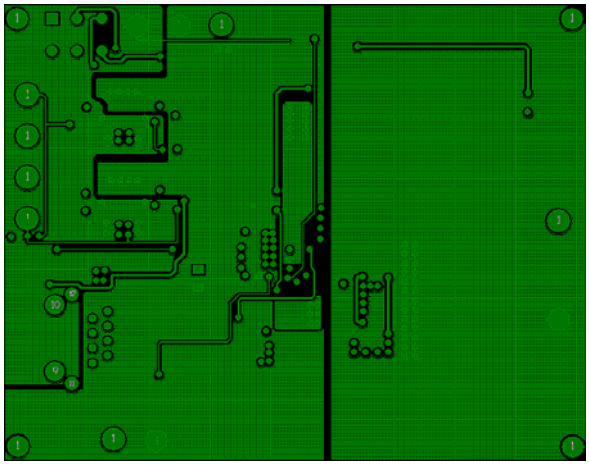


Figure 7. INNER1 (POWER) Layer

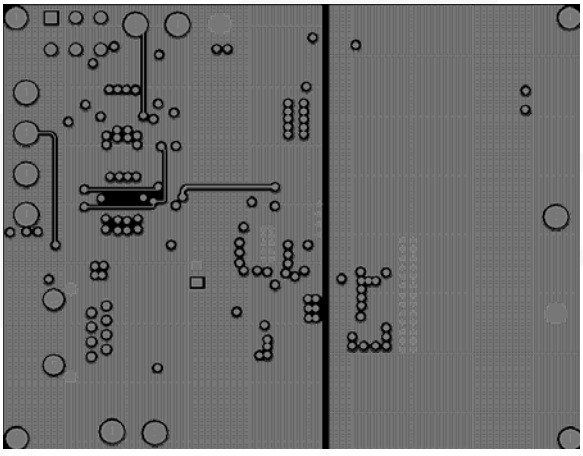


Figure 8. INNER2 (GND) Layer

5. Schematic

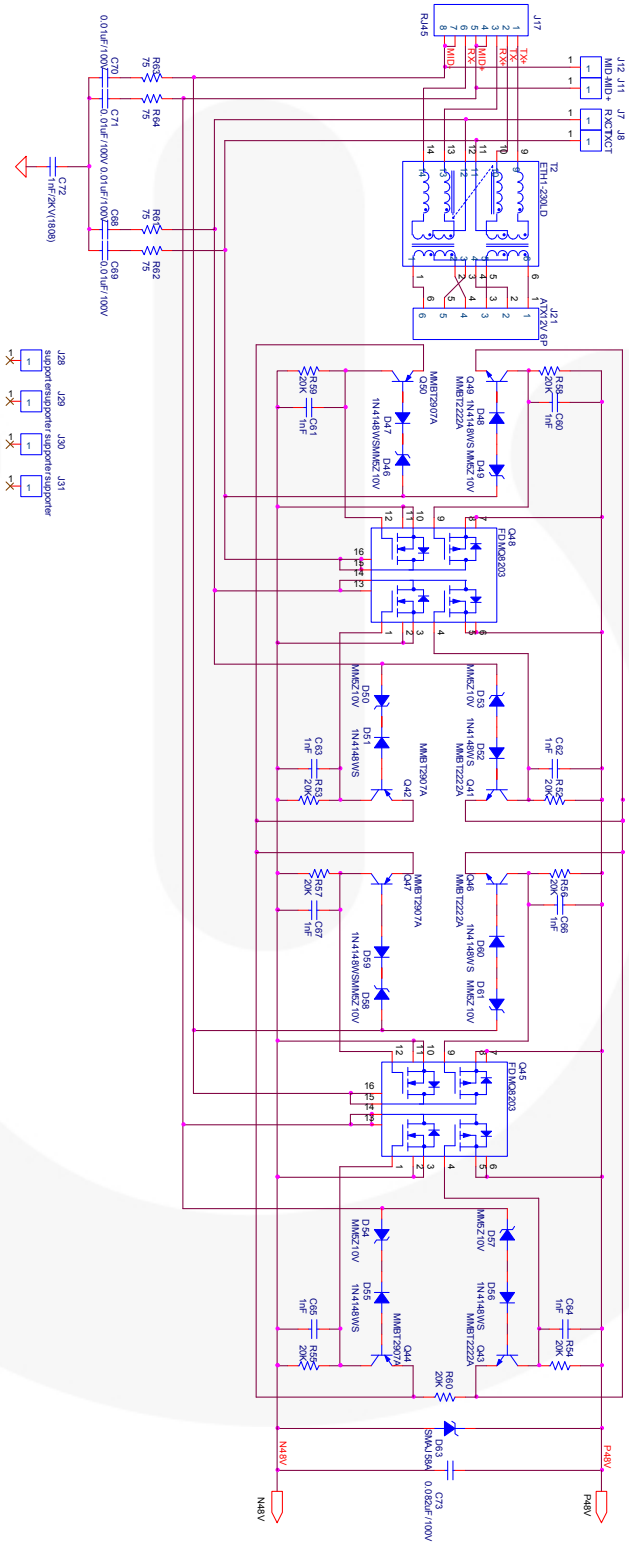


Figure 9. GreenBridge™ Block Schematic

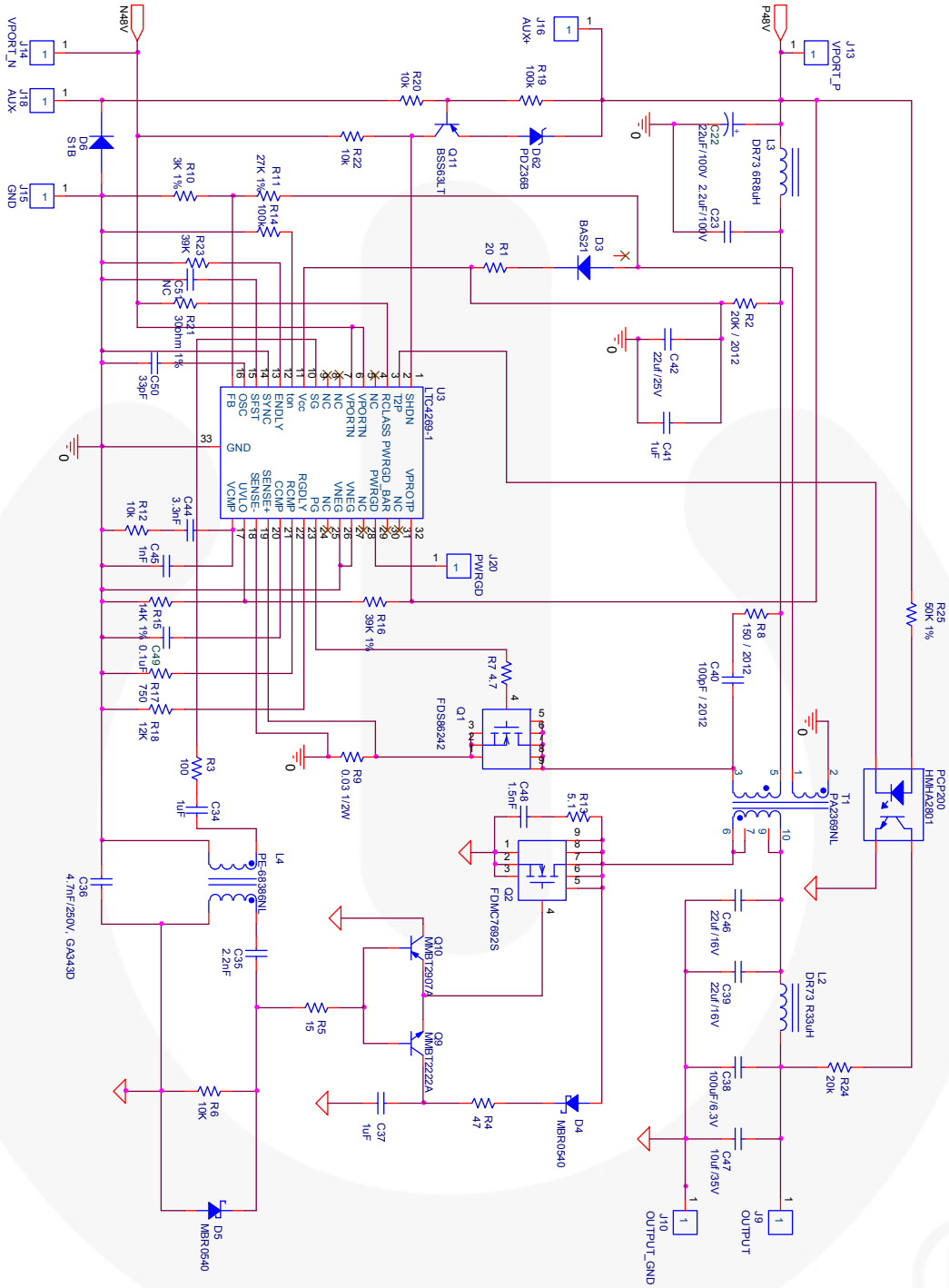


Figure 10. PoE Power Device Controller and Flyback DC-DC Block Schematic

6. Bill of Materials

Table 2. Bill of Materials

Item	Qty.	Reference	Part Name	Vendor	Comment
1	1	C22	22 µF / 100 V / Aluminum	Samyoung	
2	1	C23	GRM32ER72A225KA35	Murata	2.2 µF / 100 V / 1210
3	3	C34, C37, C41	1 µF / 1608	Any	
4	1	C35	2.2 nF / 1608	Any	
5	1	C36	GA343D	Murata	4.7 µf / 250 V / 1812
6	1	C38	F930J107MBA	Unitel Electric	100 µF / 6.3 V / 3225
7	2	C39, C46	C3225X7RIC226M	TDK	22 µF / 16 V / 3216
8	1	C40	100 pF / 2012	Any	
9	1	C42	GRM32ER71E226KE15L	Murata	22 µF / 25 V / 3216
10	1	C44	3.3 nF / 1608	Any	
11	9	C45, C60, C61, C62, C63, C64, C65, C66, C67	1 nF / 1608	Any	
12	1	C47	10 µF / 35 V	Samsung	
13	1	C48	1.5 nF / 1608	Any	
14	1	C49	0.1 µF / 1608	Any	
15	1	C50	33 pF / 1608	Any	
16	1	C51	NC		
17	4	C68, C69, C70, C71	C2012X7R2A103K	TDK	0.01 µF / 100 V / 2012
18	1	C72	C4520X7R3D102K	TDK	1 nF / 2 KV(1808)
19	1	C73	C0805C823K1RACTU	Kemet	0.082 µF / 100 V /2012
20	1	D3	BAS21	Fairchild Semiconductor	
21	2	D4,D5	MBR0540	Fairchild Semiconductor	
22	1	D6	S1B	Fairchild Semiconductor	
23	8	D46, D49, D50, D53, D54, D57, D58, D61	MM5Z10V	Fairchild Semiconductor	10 V Zener Diode
24	8	D47, D48, D51, D52, D55, D56, D59, D60	1N4148WS	Fairchild Semiconductor	
25	1	D62	PDZ36B	On Semiconductor	36 V Zener Diode
26	1	D63	SMAJ58A	Diodes	TVS Diode
27	1	J17	RJ45	Any	
28	1	J21	ATX12V 6P	Any	
29	1	L2	DR73 R33 µH	Coiltronics	0.33 µH
30	1	L3	DR73 6R8 µH	Coiltronics	6.8 µH
31	1	L4	PE-68386NL	Pulse	
32	1	PCP200	HMHA2801	Fairchild Semiconductor	Opto-coupler
33	1	Q1	FDS86242	Fairchild Semiconductor	150 V 55 mΩ MOSFET
34	1	Q2	FDMC7692S	Fairchild Semiconductor	30 V 9.3 mΩ MOSFET
35	5	Q9, Q41, Q43, Q46, Q49	MMBT2222A	Fairchild Semiconductor	
36	5	Q10, Q42, Q44, Q47, Q50	MMBT2907A	Fairchild Semiconductor	
37	1	Q11	BSS63LT	On Semiconductor	
38	2	Q45, Q48	FDMQ8203	Fairchild Semiconductor	GreenBridge™ Quad MOSFET
39	1	R1	20 Ω / 1608	Any	

Item	Qty.	Reference	Part Name	Vendor	Comment
40	1	R2	20 kΩ / 2012	Any	
41	1	R3	100 Ω / 1608	Any	
42	1	R4	47 Ω / 1608	Any	
43	1	R5	15 Ω / 1608	Any	
44	4	R6, R12, R20, R22	10 kΩ / 1608	Any	
45	1	R7	4.7 Ω / 1608	Any	
46	1	R8	150 Ω / 2012	Any	
47	1	R9	0.03 Ω / 0.5 W	HMR	Shunt Resistor
48	1	R10	3 kΩ 1% / 1608	Any	
49	1	R11	27 kΩ / 1% / 1608	Any	
50	1	R13	5.1 Ω / 1608	Any	
51	2	R14, R19	100 kΩ / 1608	Any	
52	1	R15	14 kΩ / 1% / 1608	Any	
53	1	R16	39 kΩ / 1% / 1608	Any	
54	1	R17	750 Ω / 1608	Any	
55	1	R18	12 kΩ / 1608	Any	
56	1	R21	30 Ω / 1% / 1608	Any	
57	1	R23	39 kΩ / 1608	Any	
58	10	R24, R52, R53, R54, R55, R56, R57, R58, R59, R60	20 kΩ / 1608	Any	
59	1	R25	50 kΩ / 1% / 1608	Any	
60	4	R61, R62, R63, R64	75 Ω / 1608	Any	
59	1	T1	PA2369NL	Pulse	Transformer
60	1	T2	ETH1-230LD	Coilcraft	Ethernet Transformer
61	1	U3	LTC4269-1	LTC	PoE Flyback IC

7. Electrical Characteristics

Table 3. Electrical Specification

Parameter	Value	Remark
GreenBridge™	FDMQ8203	Quad P&N-Channel MOSFET, Fairchild Semiconductor
Flyback Primary Switch	FDS86242	Single N- Channel MOSFET, Fairchild Semiconductor
Flyback Secondary Switch	FDMC7692S	Single N- Channel MOSFET, Fairchild Semiconductor
Controller	IEEE802.3at PD with Flyback Controller	
V_{OUT} Range	5 V	Adjustable by R11 and R10
Switching Frequency	250 kHz	Adjustable by C50
Maximum I_{OUT}	5 A	Limited by Power Component

8. Setup and Test Procedure

Table 4. Test Point Descriptions

Test Point	Label	Descriptions
J13	P48V	Measurement test point for rectified positive input voltage
J14	N48V	Measurement test point for rectified negative input voltage
J15	GND	Measurement test point for input voltage return
J9	+VOUT	Measurement test point for output voltage
J10	-VOUT	Measurement test point for output voltage return

8.1. Hardware Connector Description

The evaluation kit is fully assembled and tested. Follow the steps below to verify board operation.

1. Use one of the following methods to power the evaluation kit:
   - If network connectivity is required: Connect a CAT5 Ethernet network cable from the evaluation kit input port RJ45 connector to the corresponding PSE Ethernet LAN connection, which provides power to the evaluation kit. J21 connector provides an interface with the Ethernet data signals only.
   - If network connectivity is not required: Connect a -48 V DC power supply between the TXCT and RXCT. Connect a -48 V DC power supply between the MID+ and MID-.

   Caution: Do not turn on the power supply until all connections are completed.
2. Activate the PSE power supply or turn on the external DC power supply.
3. Using a voltmeter, verify that the evaluation kit provides +5 V across the +VOUT and –VOUT pins. –VOUT is isolated from the evaluation kit's input N48 V and GND pins.

9. Performance of Evaluation Board

Figure 11 and Figure 15 are measured data.

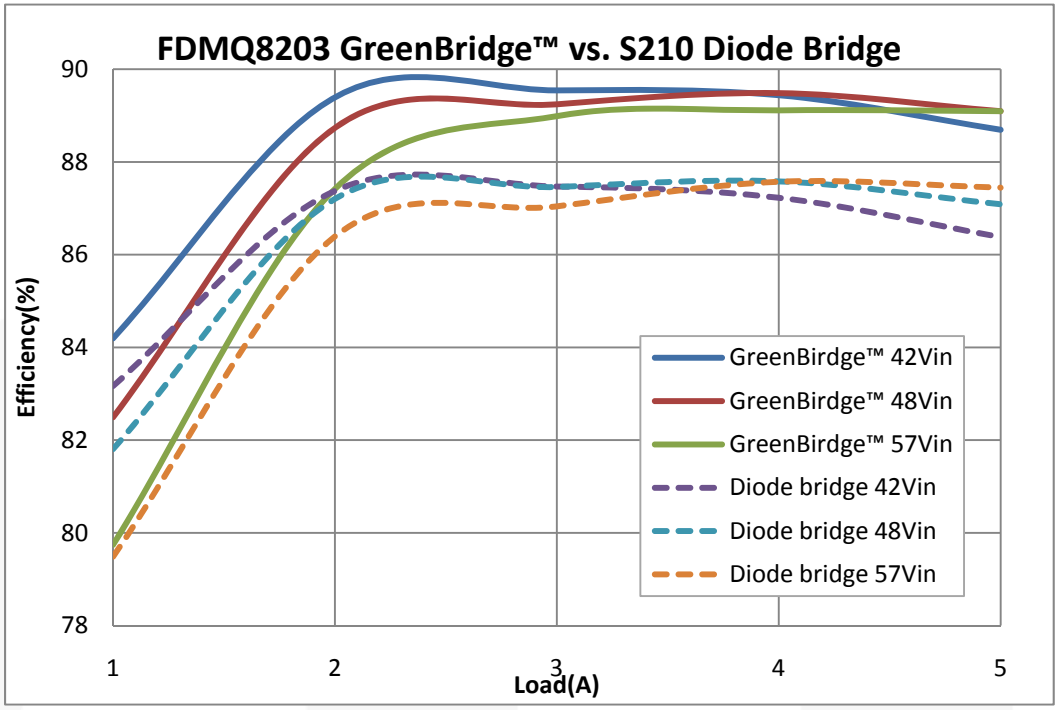


Figure 11. Efficiency at V_{OUT}=5 V, f_{SW}=250 kHz, Soaking=5 Minutes, T_A=25°C

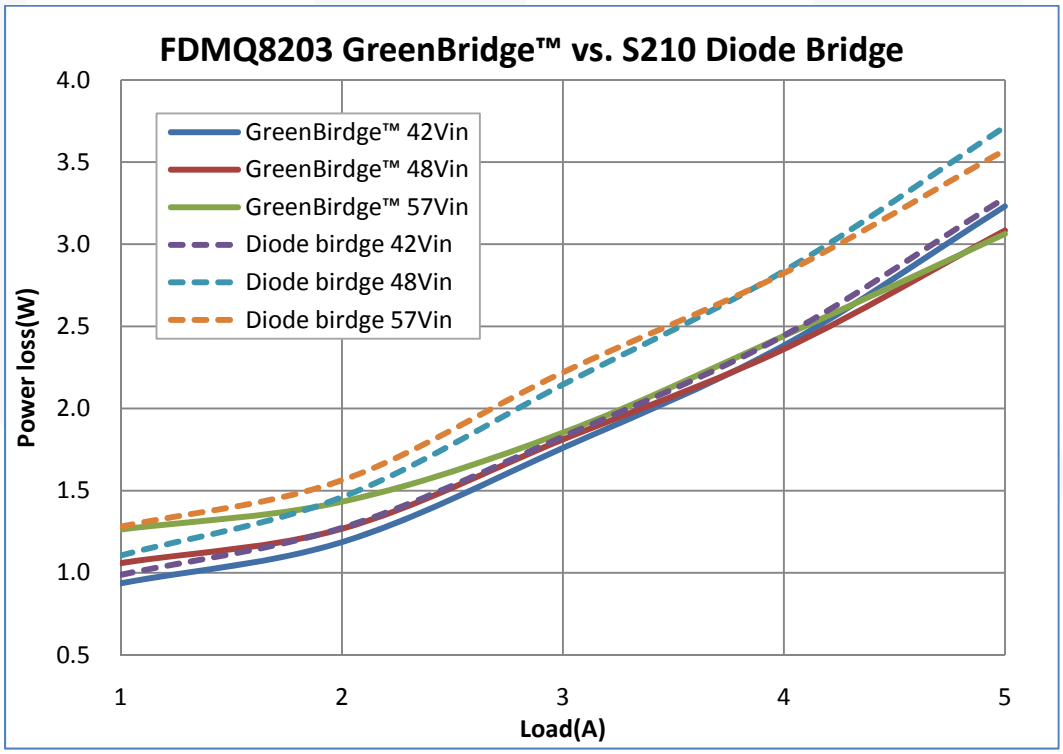


Figure 12. Power Loss at V_{OUT}=5 V, f_{SW}=250 kHz, Soaking=5 Minutes, T_A=25°C

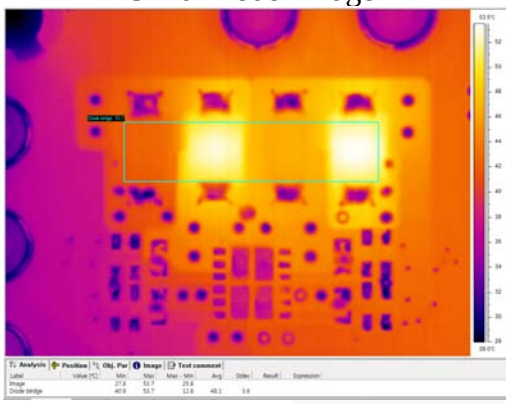
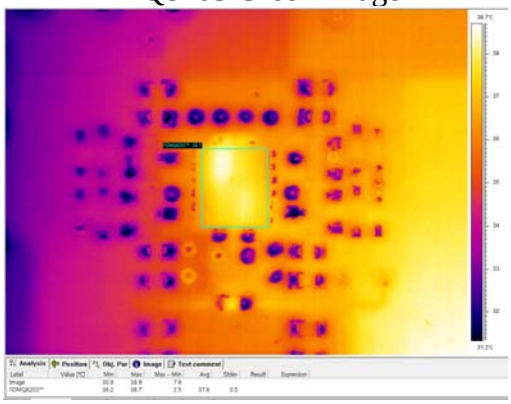
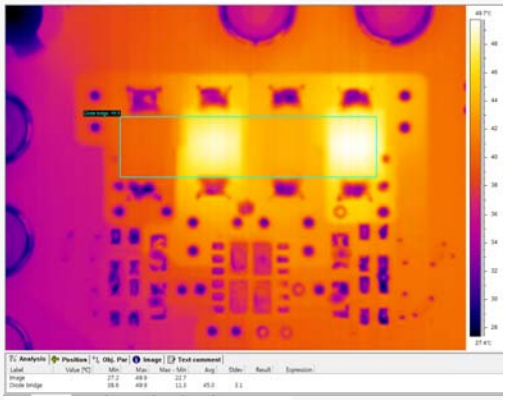
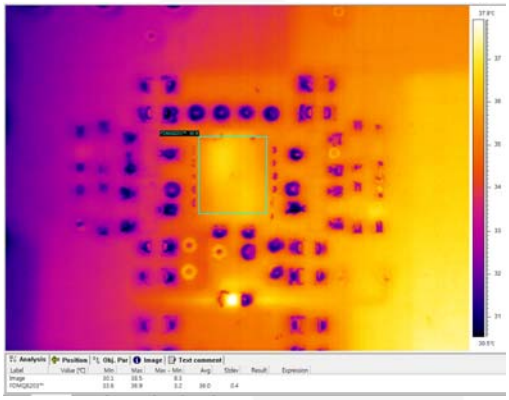
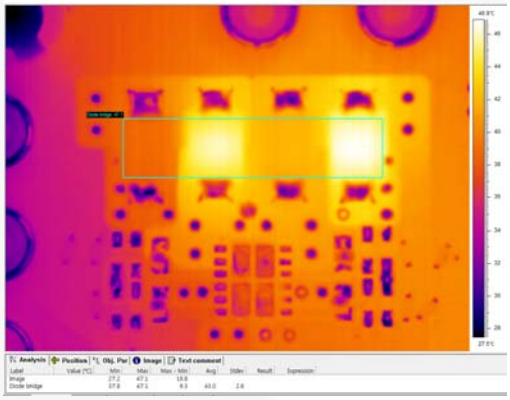
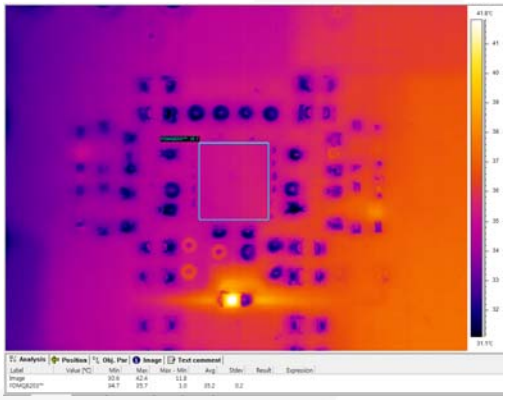
	S210 Diode Bridge	FDMQ8203 GreenBridge™
42 V_{IN}		
	53.7°C	38.7°C
48 V_{IN}		
	49.9°C	36.9°C
57 V_{IN}		
	47.1°C	35.7°C

Figure 13. Thermal Performance Comparison at V_{OUT}=5 V, I_{OUT}=5 A, f_{SW}=250 kHz, Soaking=5 Minutes, T_A=25°C

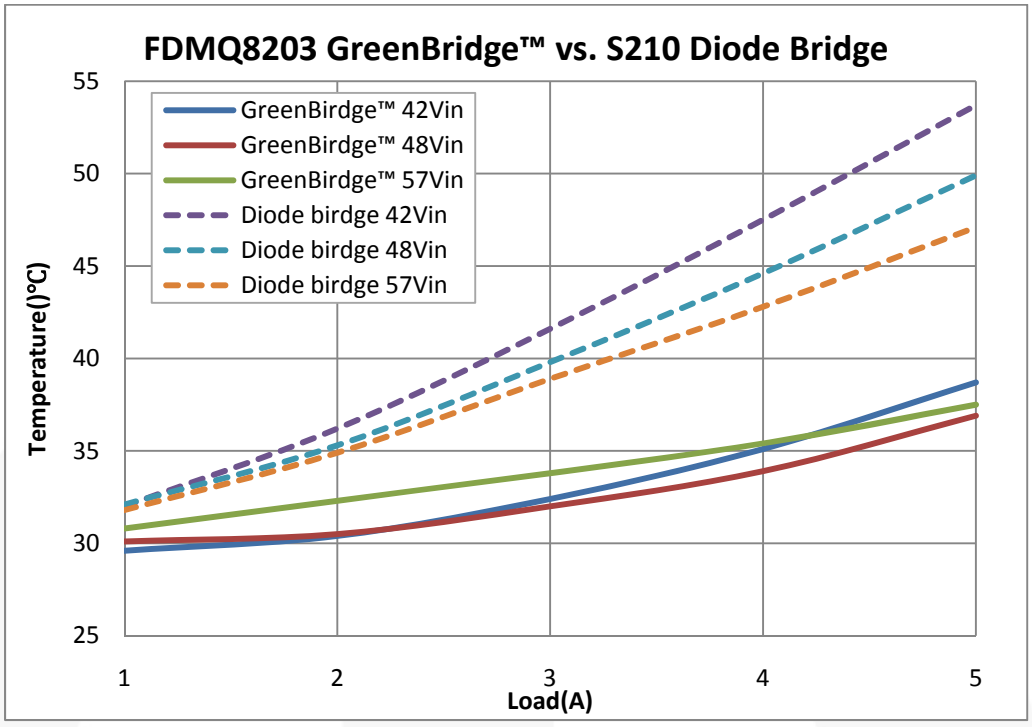


Figure 14. Thermal Performance at V_{OUT}=5 V I_{OUT}=5 A, f_{SW}=250 kHz, Soaking=5 Minutes, T_A=25°C

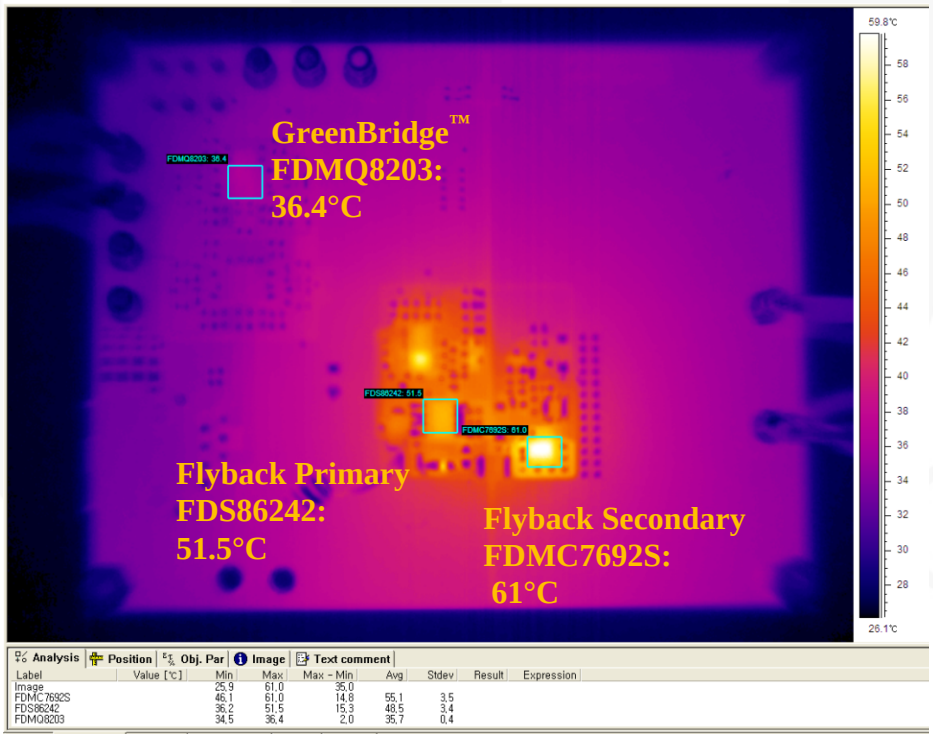


Figure 15. Thermal Performance at V_{IN}=48 V, V_{OUT}=5 V I_{OUT}=5 A, f_{SW}=250 kHz, Soaking=10 Minutes, T_A=25°C

10. Revision History

Rev.	Date	Description
0.1.0	April 23, 2012	Initial Release
1.0.0	November 28, 2012	Reformat to template, Proofread and correct content

WARNING AND DISCLAIMER

Replace components on the Evaluation Board only with those parts shown on the parts list (or Bill of Materials) in the Users' Guide. Contact an authorized Fairchild representative with any questions.

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